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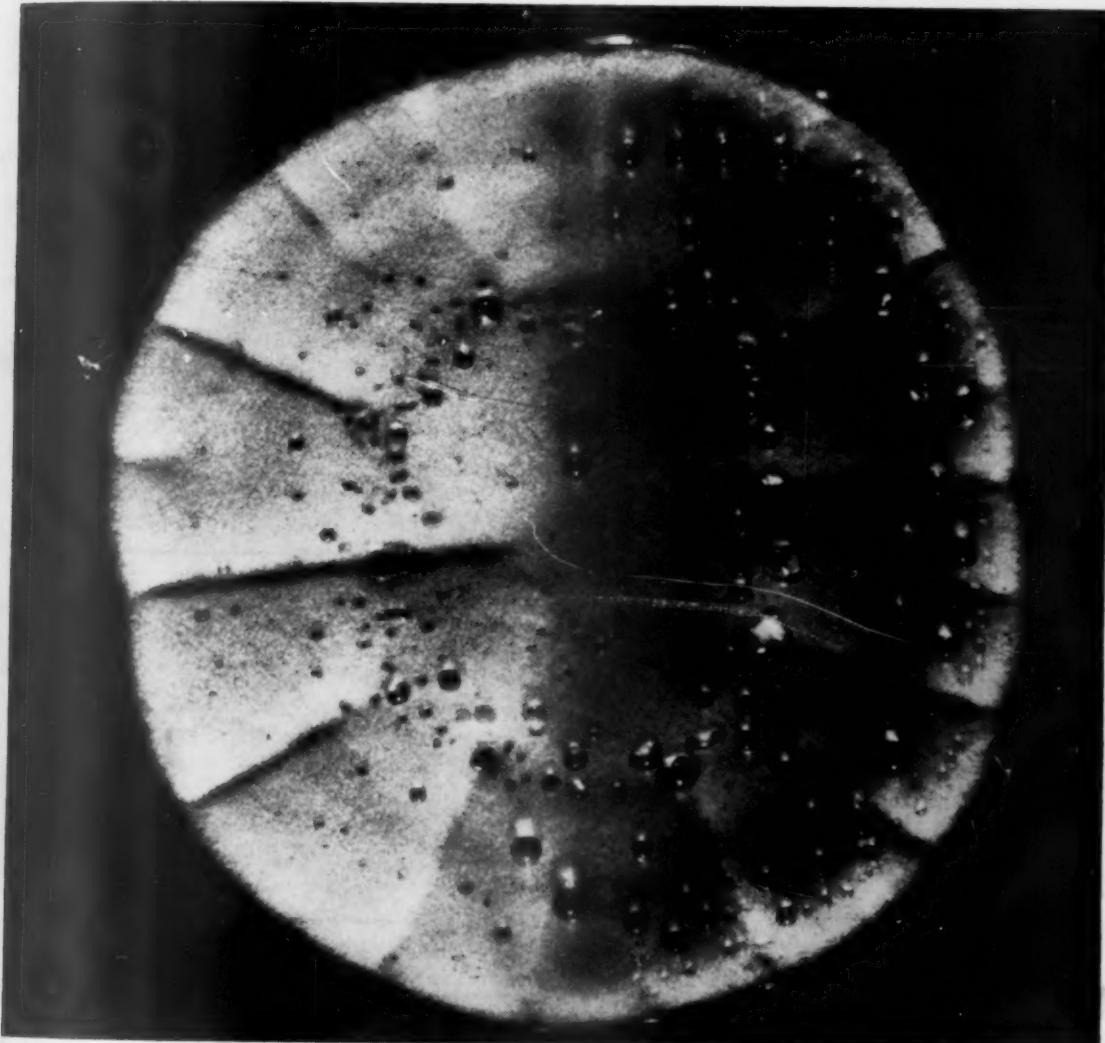
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# The American Biology Teacher

JANUARY, 1957

VOLUME 19, No. 1



**Content in Conservation  
Metamorphosis of a Scientist  
Index for Volume 18**

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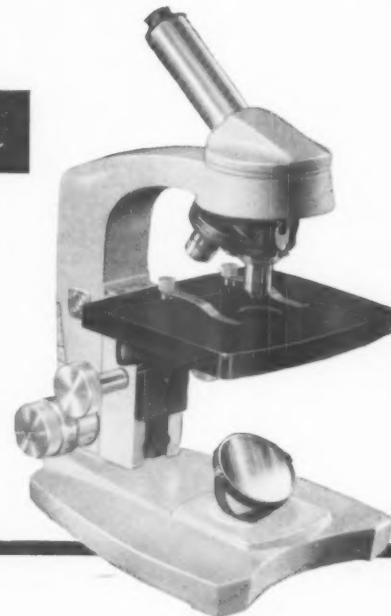
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## THE AMERICAN BIOLOGY TEACHER

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## Cover Photograph

This *Penicillium* colony was photographed by Joseph M. Riedhart, Department of Biological Sciences, Purdue University. The mycelium of this organism is normally yellow. The darkened half, which is green (at the right), is obtained by covering the left half of the colony with black paper. The right half is exposed for five minutes to direct sunlight. At present, evidence indicates that this color change is a photochemical oxidation. The globules appearing on the mycelium mat are exudate of the mold.

## Volume 18 Index Reprints

Since the index to Volume 18 had to appear in the January 1957 issue instead of the December 1956 issue of *The American Biology Teacher*, we are making available a limited number of reprints. If you wish a reprint of this material send your request to Paul Webster, Secretary-Treasurer, Bryan City Schools, Bryan, Ohio.

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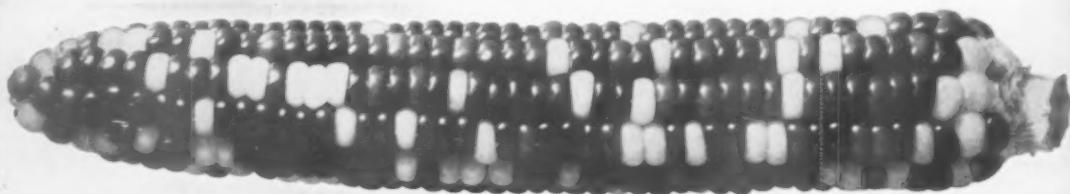
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# Desirable Content in Conservation or Resource-Use Teaching

GILBERT BANNER

Department of Botany  
The University of Tennessee

Conservation education is concerned with producing citizens capable of making intelligent judgments on natural resource matters, both as users of resources and as voters on natural resource problems.

Solutions to resource problems, like solutions to many of man's problems, depend on man's ability to recognize the nature or boundaries of the problem—is it physical, biological, social, political, or economic. Problem solving is often a matter of asking the right questions, and considering the relevant factors.

To understand man's use of the natural environment, the citizen must know the ends society desires from natural resources, the ends that are possible with known natural resources, and the means that are available for reaching these ends. If we assume that natural resource problems must include these complex considerations, what should the educated citizen know about man-resource relations to achieve a higher material and spiritual way of living, at a time when the rate of use of resources per person, and the absolute numbers of people continue to increase?

The total picture of man-resource relations embraces much of man's activities. However, certain specific issues underlie most areas of conflict in the use of resources. These issues stem from differing viewpoints toward the potential use of resources, the adequacy of present uses, the likelihood of meeting future requirements, and the relationship between the control of resources and present and potential uses.

More simply stated, the basic issue is: to what use shall natural resources of the earth be allocated, and who shall control this allocation. Only an approach that takes into account all the factors inherent in this complex

relationship is adequate for dealing with this issue.

The environment of man consists of two parts: the physical-biological part, air, water, land, and living things; and the cultural part, man's society.

Potential use of the physical-biological part of man's environment is limited by the nature of the existing materials and living forms and by the natural forces in operation. Actual use of this environment is circumscribed still further by man's culture, through which he must act on the environment. Potential or latent resources of the environment become actual resources only as man, by means of technology and political and economic organization, uses the environment, or recognizes a value for its use to satisfy his needs and wants.

What aspects of this total material-cultural environment are basic to an understanding of man-resource relationships? The following eight parts appear necessary for a well-rounded picture. Three describe the physical-biological segment of man's environment and the rest deal with its cultural aspects:

1. Physical characteristics and processes in the environment
2. Biological characteristics and processes
3. Ecological relations between these first two
4. Definition, classification, and inventory of resources
5. Societal needs and wants and the machinery for determining societal needs and wants
6. Determination of resource values and the machinery for resource allocation
7. Policy, law, and administrative machinery for resource use
8. Development, management and harvest techniques of resources

A resource problem may involve one or many of these areas. Most issues are a complex of all of them.

The first area, physical characteristics, consists of the non-living raw materials and the physical forces and processes that shape the non-living character of the earth. This includes the present physiographic structure, the cyclic and variable forces of earth movement, gravitation, and solar radiation, which produce climate, land building, and geologic weathering, and the energy and water cycles. The concept of limiting factors is but one of many physical and chemical concepts required for an understanding of this area.

The second area, biological characteristics, includes the nature of living organisms, their life cycles, the fact that each has specific life tolerances and requirements which change as development occurs in time. This area includes the photosynthetic process and resulting energy turnover as well as the mineral nutrient cycle associated with this turnover.

The third area, ecological relations, involves the interaction between the physical and biological systems, the ecology of the earth. This broadly includes the concepts of habitat and community, primary productivity and energy exchange, and food chains. It includes soil development, biological succession or change, population dynamics, and the larger problems of biogeochemistry.

The fourth area is concerned with describing and measuring resources; the definition of natural resources, types of resource classifications, and inventory of resources. This area includes the kinds of uses man makes of the environment to obtain different goods and services. The types of disservices, or social costs, that accompany these uses must also be considered. Inventory of resources includes the known quality, quantity, and distribution of natural resources, as well as demographic data. It includes the quantities and sources of resources used at present, and estimates of requirements for the future. It includes the research efforts to create new material resources.

The fifth area is concerned with the needs and wants of society and the machinery by which a society determines its needs and wants. This area includes an understanding of

societal objectives for use of resources—the concepts of levels and standards of living. It includes the criteria for measuring societal values. It is concerned with the conflicting values toward resources of different groups of citizens. Fundamental to an understanding of value conflicts is an understanding of the meaning of ownership and control of property, the legal "bundle of rights" concept, and the moral views of stewardship.

To understand how values are established, a citizen must understand the differing viewpoints toward governmental responsibility reflected in differences in Constitutional interpretations of the welfare clauses and the States' police power. He must understand governmental operation and the function of interest groups, which act as information and pressure sources at all governmental decision-making points, legislative and administrative. The role of interest groups in public education and the creation of public opinion must be understood.

This area also includes the educational efforts to create new aesthetic and recreational and scientific uses of natural resources.

The sixth area includes the institution or machinery for measuring the values of particular resource uses, and for allocating resources in our economy. Here, we are concerned with measuring societal values for goods and services, and the social costs of disservices. Involved in this area are the "intangible" values and the attempts to assign market price values to them. For this area, an understanding of our two-part economy is necessary. The private sector allocates resources by market price consideration; the public sector allocates by public vote, public or welfare considerations. This area includes the differing views toward the kinds of decisions the market or private economy should make; and whether the government should provide services that the private sector should not, cannot, or will not provide. Included is an understanding of the procedures used by the public sector; either public ownership and control, or public interference to varying degrees with the operations of the private market. Such interference takes the form of regulating the private sector of the economy by aids and grants for development, research,

technical assistance, and protection, or by providing guidance and cooperative machinery among the different levels of government.

The seventh area includes policy, law, and administrative machinery to develop and to use resources which have been allocated. This includes the present policies for the use of the many resources as well as the historical development and present criticisms of these policies. Administrative machinery includes the public agencies which control publicly-owned resources, the commissions and other bodies which regulate the private economy, and the government authorities. It includes knowledge of the cooperative machinery of government, such as inter-agency committees, state compacts, and local districts, as well as international treaties and commissions concerned with natural resources.

The eighth area includes the development, management, and harvest procedures used by those who control natural resources to produce goods and services and to decrease or prevent disservices. Here are included the specific techniques for handling the different resources and resource problems. Of primary concern in the handling of problems is the operational unit used to define the limits of the problem. Boundaries of resources or problem areas do not always coincide with ownership lines or political divisions. The definition of the boundaries of a problem determines whether the procedures used to solve it will be fragmentary or comprehensive. The following concepts, based on the preceding seven areas of man-resource relations, are used by managers and administrators to define the boundaries of resource problems and to determine the need for specific techniques; use concepts, such as use capability, multiple use, and priority of use; productivity concepts, such as sustained yield, and habitat or environment improvement; integrative concepts, such as farm plans, watershed development, and regional economic development.

This eight-part orientation toward a total picture of resource problems is by no means complete. It merely indicates that the total picture encompasses many disciplines. Expanded, this orientation may serve a useful purpose in indicating the broad knowledge necessary for intelligent consideration of nat-

ural resource problems. It may be used by the expert to emphasize those aspects of resource problems which fall in his areas of competence. It may be used by the public school teacher to present a complete picture of any local resource. It may be useful in curriculum planning, or in preparation of curriculum material, as a guide to the scope of material that might be considered, and as a guide for determining the sequential presentation of instruction, so that the total educational effort produces the desired end product, a citizen who can vote intelligently on natural resource matters.

### Viruses

Viruses, tiny organisms made of protein and threads of nucleic acid, can grow and reproduce only after invading living cells and using their biological machinery. In this way they differ from other harmful microbes.

Some kinds invade plants, causing such diseases as tobacco mosaic and producing mutants such as striped or variegated tulips. At least one variety of plant virus has been reduced by researchers to inert, lifeless chemicals and then reconstituted into a virulent agent, a feat not yet performed on any other disease-causing organism.

The structure of viruses is related to that of the chromosomes, which control inherited traits. Hence, some scientists envision a better understanding of heredity through the study of viruses. Even our concept of life is seen as possibly influenced by virus research.

Enzymes—the vital chemical agents that regulate living processes—provide a way of restoring the body's balances when they have become upset by disease or injury. Careful manipulation of these body "regulators" makes them effective therapeutic agents. One enzyme, called trypsin, has already demonstrated its value as a medicinal agent, having the function of controlling swelling. Trypsin is now widely used by doctors for treatment of illnesses characterized by swelling and inflammation. These include thrombophlebitis (inflamed, swollen veins surrounding a blood clot), black eyes and other injuries caused by heavy blows, and several types of skin ulcers.

# I Am Prejudiced

PHYLLIS B. BUSCH

*Abraham Lincoln High School, Brooklyn, New York*

Youth seeks adventure because it is one of his vital needs. The country child has this need somewhat satisfied by fishing, gardening, or even while walking on the road as he goes to school daily. City youth, instead of experiencing adventure, either reads about it or gets sophisticated vicarious thrills via television or radio. A passive listener, he becomes a passive adult who comes to accept his role in life with the idea that it is for those who are "lucky" to "have things happen to him." That is why a marriage such as Grace Kelly's stimulated the interest of our adolescents to such an extent, as well as our adults with similar adolescent backgrounds. Why do we stand by and watch children live others' lives when their own can be so interesting? Here is where the teacher comes in. A good teacher is an inspiration to his pupils. An inspired biology teacher has more at his disposal for the good and enrichment of youth than a teacher of any other area. Yes—I am prejudiced—completely one-sided and absolutely sold on the idea!

How many biology teachers do you know who teach biology as if "biology is the study of cutting up a dead frog"? They really seem to forget that it is the study of LIVING THINGS. If biology deals with life let us teach LIVING things, and let us teach wherever we can find these things alive. I can hear the voices of protest already. The city teachers will say that this is all very well for those schools that are in the country. The "exurbanites" will say that arranging for transportation to take groups on field trips is a very involved procedure. The more remote country teacher may envision other obstacles. I am afraid that these are but apologies. There is no need for transportation any further than one's feet can take him. There is no need for extra time off, extra provisions, extra anything. There is need only for teachers willing to accept the challenge to teach biology with enthusiasm and imagination, with an appreciation of ecology, and with an

understanding of conservation of all of our resources, including that part of our precious human resource, youth.

The challenge is naturally greater in the city, but that means that an urban biology teacher can do much more for his pupils. Let me give you an example of a procedure which I followed with a biology class last term at the Abraham Lincoln High School in Brooklyn, New York. I was on the third floor of this city school of over 4000 pupils, with a principal who was sufficiently interested in children to share my enthusiasm and ideas. Because of certain administrative details it was easiest to carry on our outdoor work on Tuesdays. As a result, our biology periods on Monday were very exciting planning periods. We had to forecast weather and make suitable arrangements for proper dress. We had all agreed to go out regardless of the weather, since we should be sufficiently intelligent to dress accordingly. Some very interesting observations were made on the kinds of clothing that keep one warmest. This information was used in a lesson on the adaptation of warm-blooded animals to their environment. A very important educational outcome was the pupil-teacher planning that preceded a well organized trip. The students had to recognize those problems which were pertinent to the topic being studied. We also had to have somewhat of a plan formulated to help us solve these problems before going out on the trip. Here is an example. While we were studying protozoa the pupils expressed an interest in the presence of these organisms in drinking water and in other places where water is found. It is one thing to establish a culture in a battery jar in a classroom, and quite another to look for protozoa in places which are part of our everyday environment. In addition to examining samples from home and school we decided that it would be worth our while to find whether such organisms occurred in water puddles outside, and in the soil around the school. We would also compare the

numbers with the numbers in the cultures. One pupil wondered whether we might also look for bacteria. Accordingly, we left room 338 the following day with some stools, microscopes, prepared petri dishes, and the other essentials planned by the class and necessary to carry on the investigation. Sure it took effort. Sure it took time. But you should have seen and heard what I saw and heard. These children were having a most exciting adventure and learning an enormous amount of science. One boy said to me, "You mean that this water can be purified and made good to drink?" We discussed that the following day. The techniques of water purification which the class had had in general science were reviewed and a plan for checking purified water was made. The boy carried on his investigation all by himself. This is a very usual procedure in these classes. So many problems present themselves to the children. They need only encouragement in order to pursue them.

When we were engaged in finding out what makes dandelions crowd out the grass on the school lawn, in connection with our work in conservation, one pupil thought that she would like to know how fast dandelion seeds germinate compared to grass seed. She had a neat little problem. Her biggest problem was that no one in school could tell us what kind of grass was planted on our lawn. This project became involved and exciting for this girl.

When we studied secondary sex characters we walked only about a half block to observe pigeons and sparrows. This turned out to be one of the most exciting experiences which the class had. One would think that they had never seen these common birds, and in a sense they had not. When, on the following day as we were discussing our findings, I asked about the characteristics of the feet of the birds, most of the students either did not know or never noticed the limbs. This required another observation on their way home that day. The difference in the feet structures was used as a basis for the study of classification.

Many city children never saw a clover plant growing, although it is certainly very common. They are found on lots or street borders. Have the pupils measure off a square foot and then count the number of plants. How many four-leaved clovers can they find?

Compare the shapes and sizes of a number of leaves. Here is variation and mutation that is meaningful. Dig up a clover plant to see the root nodules. How much more meaning can be put into an explanation of its value than talking over a dead plant in a bottle of preservative? Note that none of these trips are meant to extend beyond a regular period. We simply adapted our program to our allotted time. We worked in an outdoor laboratory.

Trips need not and should not be limited to fair-weather months. Just as living things exist in the winter too, it is part of our adventure in learning to see what they do when it is cold. Are there insects underneath the snow? What temperatures do we find in the snow, above the snow, and underneath? On what side of the building is the snow melting faster? Is there anything green on any side of the school? Why? What difference is there in the sun now? How are the seasons affecting the various areas around the school? What things die completely and what living things leave some recognizable provision for the next generation? What animals walk in the snow—rats, cats, dogs? Why? Where? Investigations can be kept simple or their complexity can be increased to meet the particular needs of some individual or group. The differences in the bacterial count in snow and rain might be compared, studies of their pH might be made, then examined in relation to location, the life supported, etc. Possibilities are really endless. Note that very little, if anything, has been said about identification. Among the many words of wisdom which Dr. Eva Gordon, professor at Cornell University, and one of the most stimulating teachers I ever had, imparted to me, was this sentence, "If all that you can say about a living thing is its name then you might as well forget it." When there is so much that you can help children learn about living things, merely learning names becomes sterile. However, time and again children want to know names. Show them how they can find out for themselves. This can become a very interesting part of a unit of work on taxonomy.

So much could be written about the opportunities for studying life when studying biology with the accompanying extra rewards. These rewards enrich the pupils, but even more so, the teachers. As the terms go by the interest on his investment accrues enormously.

## Monstera in Bloom

REVEREND A. M. KEEFE

Professor of Botany

St. Norbert College

West De Pere, Wisconsin

A Monstera plant surprised St. Norbert College summer school students by blooming in the laboratory. This oversize, popular, houseplant, sometimes incorrectly known as *Philodendron pertusum*, has been growing for several years on the botany laboratory window sill. It takes a lot of room, but it supplies the instructors with a continuous demonstration of aerial roots.

Early in May the apex of the plant, which nearly brushed the high ceiling, began to put forth three peculiar and unusual sprouts, looking more like small ears of corn than anything else. These were flower buds. The first opened on 15 June, the second on the 22nd, the third had not unfolded when this article was written.

Monstera belongs to the same plant group as the Jack-in-the-pulpit and the Skunk Cabbage on the one hand, and the familiar florists' Calla Lily or the *Anthurium*, on the other. They are all Arums, and the so-called "flower" consists of an outer sheath, the spathe, and an inner stalk of minute flowers, the spadix.

The spathe in the Monstera is a creamy yellow in color, but as soon as the spadix flowers are pollinated, it turns brown and falls off. The spadix, which is ivory yellow at first, turns green when pollinated, and resembles an 8-inch pine cone, the rind being composed of six-sided green plates. The fruit is edible, much appreciated in tropical countries, and is said to taste like something between a banana and a pineapple.

The St. Norbert Botany laboratory has two of these huge plants, also noted for their curiously slashed and perforated leaves. They have to be suspended from the tops of the window frames by cloth bands. In the tropics they climb trees, suspending themselves by long aerial roots produced in profusion, which wrap themselves about their support. Forty foot coconut palms are sometimes almost "strangled" by the sheath of Monstera roots



Monstera blooming—Photo by Aschert

which has formed around them. Where they are grown commercially they are allowed to clamber over the ground in open fields something like cucumbers and they produce more fruit that way.

Where there is sufficient room, Monstera makes a very conspicuous interesting houseplant. They endure a wide range of temperature. They like a rich soil and plenty of water. The St. Norbert specimens are only a small part of over 150 or more exotic plants which are being grown in the laboratory.

# Easily Controlled Staining of Nerve Tissue For Large Laboratory Classes

J. EUGENE MIELCAREK

Dept. of Research

Kansas City College of Osteopathy and Surgery

Those engaged in teaching histology, neuroanatomy and other biology laboratory courses have need for silver stained sections of brain and spinal cord tissue. The objective of this study was twofold; to prepare mounted serial sections of brain stem and spinal cord areas as general anatomical orientation aids in the laboratory, and to establish a technique which would be easily controlled, consistent and predictable enough for student performance. It was hoped that aids to mass production of many sections for each student in classes of one hundred could also be established.

The intended use for the sections was student identification of large landmarks such as the olfactory nucleus, the pyramidal tracts, etc., the slides being placed on a microscope light and studied by means of reverse ocular or other low magnification. The following is an account of a technique which served the purpose very well.

A survey of the literature revealed much detailed information on the subject of silver staining methods. An excellent introductory reference is the paper by Davenport, 1929 (1). The technique described is essentially a modification of Davenport's technique. Detailed information on the mechanisms involved in silver staining is presented by Peters, 1955 (6-10), and Wolman, 1955 (14).

## MATERIALS AND METHODS

In the present study, the material used was human brain stem and spinal cord tissue from cadavers which had been placed in 10% formaldehyde for preservation. The material had been embalmed anywhere from six months to one year and had been in formaldehyde for three months. The embalming process was intravascular injections of the embalming fluid by the morticians, followed by intramuscular

injections of a fluid consisting of 40% formaldehyde (3 parts) carbolic acid (2 parts) and glycerine (1 part).

### A. Washing and Embedding

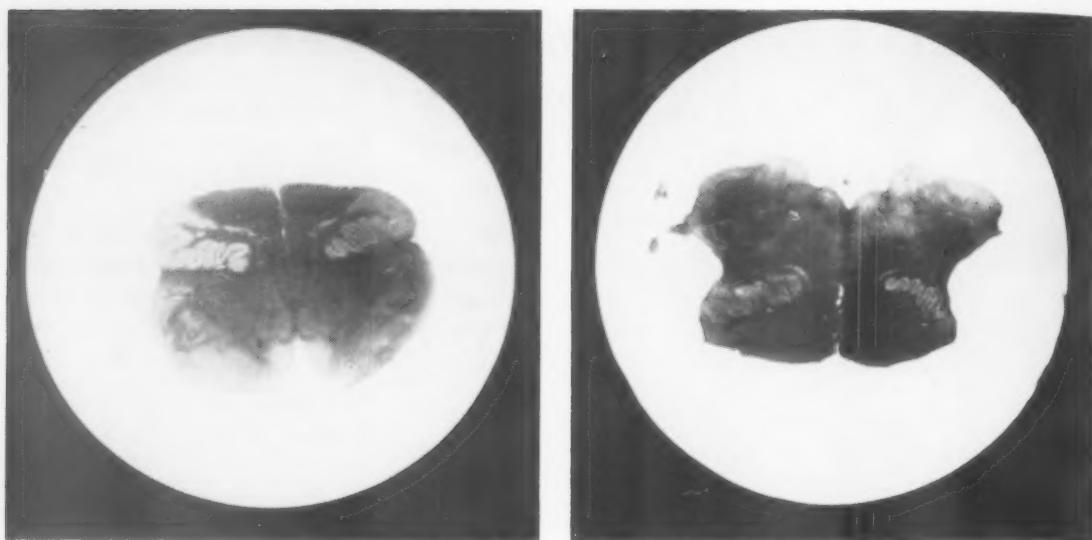
The brain stems and spinal cords were first placed in 30% ethyl alcohol for 24 hours. Then twenty-four hours in 50% ethyl alcohol and 70% ethyl alcohol. The material was placed in 95% ethyl alcohol for 48 hours. Two 24-hour baths of absolute ethyl alcohol followed; anhydrous copper sulfate being added to the second bath as a precaution against hydration.

The dehydrated material was placed in a solution which was 50 parts absolute alcohol and 50 parts anhydrous ether for 3 to 5 days. The material was transferred to thin collodion for 96 hours and was then placed in dishes, the bottoms of which were covered with a floor of thickened collodion. A large volume of thin collodion was poured over the specimens and thickened by chloroform fumes in a vacuum. The blocks, when cast, were mounted on wooden holders which had been baked in an oven and then dehydrated in an ether-alcohol solution. Sections varying in thickness from 5 to 30 microns were cut and placed in 70% ethyl alcohol. Uncut blocks were stored in chloroform.

### B. Staining

After many staining trials with numerous stains, the best results were obtained with a modification of Davenport's silver stain. (2)

The sections when removed from 70% alcohol, were put into a tray and were covered for a two-hour period with a solution consisting of 15cc of concentrated nitric acid and 85cc of 95% ethyl alcohol. After removal of this solution, the sections were rinsed in ten separate changes of 80% ethyl alcohol. A thorough rinsing was found essential. The rinsed sections were next covered with a



FIGURES 1 AND 2—Cross sections of *Medulla Oblongata*

silver nitrate solution. (10 grams of silver nitrate crystals dissolved in 90cc. of 95% ethyl alcohol) for 12 or 24 or 48 hours. Equally good results were obtained in mass staining sections of various thickness at any of these staining times. No significant variation was found in temperature between 37 to 50 degrees C. The silver nitrate was poured into the vessel in near total darkness. After being in this solution for 12, 24 or 48 hours, the sections were rinsed three times in absolute alcohol. The sections were then examined in very dim light and the darker sections were separated from the lighter sections. The darker thick sections were left in alcohol for one hour and were then developed for two minutes in a solution consisting of three grams of pyrogallic acid, 5cc. of neutral formaldehyde and 95cc. of 95% alcohol. The lighter sections received only the three rinses in alcohol and were developed in the same solution for a twenty-minute period. Following this, the sections were rinsed in 50% ethyl alcohol. It has been stated by Geyer (3) that the sections should be fixed until chocolate brown in a 10% solution of sodium thiosulfate. Results of this experiment indicated that a modification was necessary. The rinsed sections were covered with sodium thiosulfate for 24 hours. The sections were then individually reduced in a solution of 4 grams of potassium ferricyanide in thirty cc of water. During

reduction, which varied anywhere from ten minutes to an hour, depending upon the thickness of the section, the sections were checked with a ten-power ocular reversed over a standard microscope lamp. Reduction was considered complete when typical landmarks in a section were easily seen. (Fig 1, 2).

When reduction was complete these sections were rinsed in water, washed for two minutes in 10% sodium thiosulfate, rinsed quickly in water and then put through an ascending series of alcohols until they were in absolute alcohol. At this point, there were difficulties in handling the thick colloidon sections which were rigid, making the sections difficult to mount. These sections were softened by dipping them into a mixture of 25% anhydrous ether and 50% chloroform. The softened sections were then rinsed in absolute alcohol and placed in xylol. The sections were mounted in a xylol base H.S.R. mounting medium.\* Occasionally sections with streaks of precipitate were encountered. These were salvaged in the following manner: the sections were reduced as usual. When all of the sections were reduced except for the streaks a small cotton wad, soaked in a solution consisting of equal parts of 10% sodium thiosulfate and potassium ferricyanide

\*Synthetic Mounting Media  
Procured from Hartman Leddon Co.

was drawn lightly over the streak until that area was as light as the rest of the section. In order that many sections could be stained at one time, plastic ice trays with 60 slots for chipped ice were used as staining vessels. Identical results were obtained in control sections stained in glass vessels. The slots were numbered and the serial arrangement was thus maintained. At one point in the process a fairly rapid change of solutions must take place. Transferral of 60 sections to another vessel is time consuming, so a well-fitting screen with spaces smaller than the slots was procured.

#### Conclusions:

Silver stained collodion sections of nervous tissue valuable for student examination can be prepared by a simple and easily controlled technique which has reasonable pliability for mass production for large laboratory classes.

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## Observing Plant Roots

WILLIAM LOPUSHINSKY  
New York State College of Forestry  
Syracuse, New York

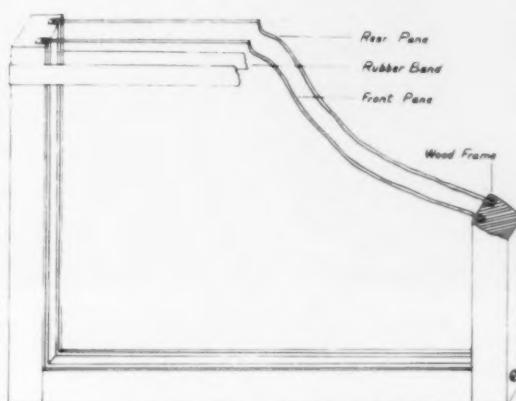


FIGURE 1. A glass box for observing the growth of roots.

During an investigation of the inhibiting effect of a growth regulator, ammonium naphthyl acetate, on the root growth of bean plants, several methods of growing plants were employed (1). Initially, bean plants were grown in ordinary 4-inch clay pots and the effect of the growth regulator was determined by removing, drying and weighing the roots. Later, a more satisfactory method, whereby the growth of undisturbed roots could be observed, was desired, and plants were grown in glass boxes designed to permit continuous observation of root growth. This method proved very successful and may have use in other root growth studies. This paper is devoted to a description of the method and a discussion of possible applications.

As shown in Figure 1, a glass box consists of a 3-sided, U-shaped wooden frame with 2 glass sides. The frame measures 12 x 12 x 1 inches and has 2 parallel saw kerfs on the inside. The 2 glass sides (window glass) slide from the top into the saw kerfs and when in place are 9/16 of an inch apart. A large rubber band was used to strengthen the frame and prevent the glass from sliding out accidentally.

The glass boxes were filled with a soil aggregate to facilitate drainage and aeration.

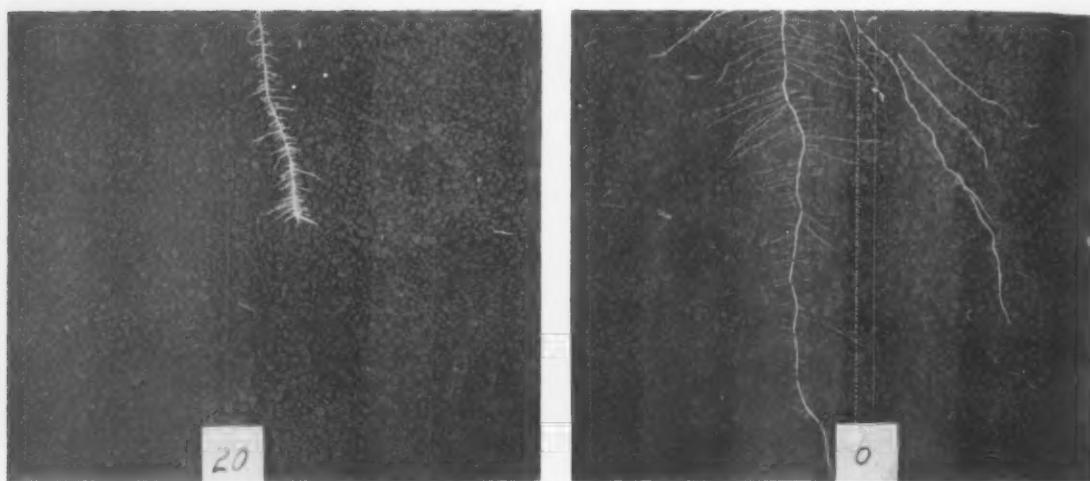


FIGURE 2. Right: Normal root growth of untreated bean plant. Left: Inhibited root growth caused by watering with 20 p.p.m. of ammonium naphthyl acetate.

The soil aggregate was obtained by twice screening ordinary top soil. The first screening with a coarse soil screen removed stones and debris. The screened soil was again screened with a standard number 10 soil screen and the soil aggregate used was that portion which would not pass through the screen.

Three bean seeds were planted in each glass box to assure the presence of at least one good plant per glass box at the beginning of the experiment. The glass sides were covered with black paper to exclude sunlight thereby preventing the growth of algae in the soil. The boxes were then tilted forcing the roots to grow along the lower glass surface where they could be easily observed. The plants were watered daily with 50 ml. of tap water. When the roots of the plants had attained a length of 3 to 4 inches, two plants were removed from each box. The remaining plant was watered with ordinary tap water or treated by adding various concentrations of water solutions of ammonium naphthyl acetate to the soil in the glass boxes. The effect of such treatment is shown in Figure 2.

The main advantage of the glass box method is that it permits visual inspection of plant roots without disturbing them. The effect of any treatment on the growth of roots can be easily observed and photographically recorded at any stage of root development.

This method of growing plants could be used in any root growth study where the investigator wants to observe the normal growth and behavior of undisturbed plant roots or the effect of experimental treatment on such roots. The glass box method could also be used in providing demonstration material for botany or biology classes to show the relative growth rates of roots and shoots, root form and presence of root hairs.

The glass boxes described in this paper were used for almost a year without any noticeable deterioration. However, a permanent, decay resistant glass box could be made if a workable plastic, like Lucite instead of wood, was used for the frame.

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#### Visualized Handbooks

The Visual Instruction Bureau of the University of Texas is publishing a series of visualized handbooks for classroom teachers. Four titles in the series "Bridges for Ideas" have now been completed; "Felt Boards," "Bulletin Boards," "Lettering Techniques," and "Tear Sheets." Write the Bureau in Austin.

# Organizing a Nature Study Course

LAVANIEL L. HENDERSON

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The elementary education curriculum at Texas Southern University includes a course titled "Nature Study" wherein subject matter relative to the presentation of certain phases of science to elementary school pupils is considered. As originally designed, this course included information pertaining to plant and animal life only. It now encompasses a study of the atmosphere, rocks, minerals, soil and water. Recently, the Biology Department has assumed responsibility for this instruction. Details of efforts to fulfill this responsibility follow.

## Collection of Literature

One of the first steps taken was an attempt to determine the availability of suitable literature pertaining to the teaching of the several phases mentioned above. A pamphlet, "Free and Inexpensive Material for the Teaching of Conservation and Resource Use" by Muriel Beuschlein of Chicago Teachers College, provided a list of sources from which literature and other materials could be obtained. Through the use of this booklet we now have on hand over four hundred pamphlets, books, and charts. A portion of this collection has been indexed and is now in use. Our card file indicates the following distribution of materials.

Subject	Number of References
Animal life .....	120
Plant life .....	182
Wildlife Conservation .....	36
Soil and Water .....	55
Natural Resources .....	7
Teaching of Science	
Teaching of Conservation	
Field Trips .....	34
Bibliography .....	7
Miscellaneous .....	22

The above materials are utilized in the following manner: reading assignments; oral reports; preparation of teaching units for elementary

grades; sources of information for group discussions; and laboratory guide for class demonstrations.

The outlined activities are correlated with lecture presentations and are considered a part of the laboratory phase of the course. Whenever a particular pamphlet or chart is used, the address from which it was obtained is made available to the members of the class. The individual collection of literature is encouraged. A large portion of the literature in this collection is concerned specifically with methods of teaching nature study and other science to elementary school pupils.

The University library resources are also consulted for related data. A mimeographed reading list compiled from library sources also is distributed to the members of the class. This list which presently includes eighty-three articles selected from recent issues of *The Instructor* and *Grade Teacher* is also used for reading assignments, reports, and class demonstrations.

## Scrapbook

In order to direct attention to literature other than that designed for persons teaching the elementary grades but which may be incorporated into teaching efforts, each student constructs a scrapbook including pictures and articles from newspapers and popular magazines. Such publications provide a wealth of understandable material pertaining to nature study and science in general. The scrapbook is checked at the end of the semester and thereafter it remains the property of the student.

## Surveying a Locality for Teaching Resources

Seymour (3) stated that the county survey technique is valuable in aiding students who are interested in conservation in overcoming "a lack of knowledge of the homefront." Since the elementary teacher often utilizes local surroundings in the teaching of nature study, an attempt is made to provide experience in sur-

veying a given area with the view of planning field trips. To effect this phase of our course, each student makes a survey of his home county with reference to resources which may be used in teaching efforts on the elementary level. Special emphasis is placed on plant and animal life, rocks, minerals, soil and water.

#### *Study of Rocks and Minerals*

As mentioned above, a phase of our lecture effort is concerned with the study of rocks and minerals. Correlated activity includes reading assignments from our reading list and literature collection. In addition each student includes in his county survey data relative to important rocks and minerals. To further enhance this phase of our work, we study selected samples of the aforementioned materials. Over sixteen state departments of geology and other organizations have provided us with collections and/or samples. Others will be added. Several of the collections are contained in convenient display cases with a list of the samples included therein. Others are accompanied by booklets describing each sample. A portion of our laboratory work is now devoted to the arrangement of our remaining collections in display cases and the preparation of data sheets describing each sample. Our objectives in these endeavors are: (1) to aid the student in obtaining information concerning rocks and minerals, (2) to designate sources from which samples and collections may be obtained, (3) to emphasize the value of such aids in teaching, and (4) to consider techniques in the preparation of rock and mineral samples for classroom use.

#### *Study of Living Things*

Prior to his enrollment in this course, each student will have completed Introductory zoology and botany. Consequently, extensive efforts are not made to acquaint the class with basic facts concerning plant and animal life. Rather, methods of teaching biological facts to elementary pupils are emphasized. Here again our reading list and literature collection mentioned above are utilized. The course is one semester in duration, therefore it is impossible to offer adequate taxonomic principles or to present a sufficient number of specimens representing the groups of plants and animals common to this area. On the other

hand, attempts are made to bring to the attention of the class simple keys and references which would aid in the identification of large taxonomic groups. Berka (1) has pointed out the value of such keys in the teaching of biology. Two references which have proved helpful in teaching the use of a simple key are: "Plant Families and How to Know Them," revised edition, by H. E. Jaques and "Insects," the Yearbook of Agriculture, 1952. Future plans include the construction of simple keys for the identification of plants and animals common to this locality.

#### *Follow-up*

Several students have reported that this course has aided them immeasurably in their practice-teaching. This prompted a decision to maintain a record of each student's address in order that a plan may be devised to determine the value of the above efforts in terms of providing information which is useful in the classroom. It is also desired that the student and the instructor exchange information pertaining to the various aspects of nature study teaching in the elementary schools.

In addition to presenting phases of methodology relating to the teaching of nature study, the author hopes to create an appreciation for the marvels of nature as expressed by Harvey (2) in reference to the teaching of Biology.

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## **Cancer Starvation**

Can cancer be starved out? Well-known scientists have said, "No," but experimental evidence suggests promising possibilities through the combined attack of dietary control and chemicals harmful to cancer. Studies show that the life of a tumor-bearing animal may be prolonged through diet control. This may make it possible to use chemotherapeutic agents—chemicals such as the "triethylenimines" that are detrimental to cancer—to slow up, stop, or even cause regression of the cancer.

## Metamorphosis of a Scientist<sup>1</sup>

ROBERT D. MacCURDY

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College of Education  
University of Florida

*Shortage of Scientific Manpower.* Some educators of vision and insight have warned for several years that we face a critical shortage of scientists, engineers and science teachers. When the facts could no longer be ignored a general clamor of words arose: "Who, what, when, where, why" was asked in every quarter. Various groups of people, socio-economic factors, schools of thought, movements, were blamed for the condition. The shortage remained. Finally the questions seemed to be: How can we identify the potential scientist while he is very young and what can we do to stimulate his growth and development? The idea is an old one of course, find an ideal model and then create more in its image.

*Studies Guide the Way.* Several studies were published which related to this problem and contributed toward its solution. Meister (5) showed the role of scientific toys in the generation of science interest. Zim (8) described the science interests and activities of adolescents. Brandwein (2) showed the influence of the school program and the science teacher in shaping the young scientist. Goodrich and Knapp (3) described the young scientists' college years. Terman (7) and also Bello (1) described his young adulthood. Roe (6) described the late near-twilight time of his productive scientific life. Similarities were revealed in all these studies that suggested a line of approach to the problem.

*Research Begin.* Science Clubs of America cooperated, and a study of the Science Talent Search contestants (164 Honorable Mention winners who had an occupational choice of Research Scientists) was undertaken. The details of this study have been reported elsewhere and will not be repeated here.<sup>2</sup> There are about a hundred and fifty factors which



Arthur Green, student at P. K. Yonge School, Gainesville, has been conducting a study to see how different diets for rats will affect the take-up of radio-active calcium.

are characteristics of potential scientists and factors that were found in his background. They can be grouped and generalized, however, into even larger groups, and when this was done it was found that four basic factors remained in the metamorphosis of the scientist: capacity, interest, scientific influences, and freedom.

When a housewife discovers a new cooking delight she frequently wants the recipe. If she obtains it she wants to try it out at home and "see if she can make it" also. The same logic will tempt teachers to select the factors in the metamorphosis of scientists apply them to life and see if some more young scientists appear. If we take these factors and build a socio-economic-educational environment we find something like the following:

*The Child:* By his own words we must select him while he is still in elementary school. It was at this time in his life when he first became interested in science played with science, had dreams about building a better world and made a lifetime career commitment. This means that most of us must lower our sights almost from the grave to the cradle in order to find the rare gem that we seek.

*The Parents:* There is little evidence that nature or America compensates. The potential scientist comes from homes of comfort, culture, convenience and freedom from most kinds of autocratic dominance. He has every opportunity to be stimulated by the good influences in life and to grow at his own speed following his own interest. The parents of

<sup>1</sup>Presented at the Florida Chapter of Society of American Foresters, Semi-Annual Meeting, November, 1956, Sportsman Lodge, Welaka, Florida.

<sup>2</sup>MacCurdy, Robert D., "Superior Science Student and the Sub-Groups," *Science Education*, 40:3-23, February, 1956.

this first-born child, our potential scientist, have experienced many advantages in their life. They provided equal or better opportunities for their children: a place, tools, supplies, family, friends, chums and a permissive democratic and progressive environment for their son.

*The Associates:* While there were few social activities and contacts in the life of the potential scientist, they were high in cultural quality and mostly professional or scientific people. From these contacts the potential scientist derived help, inspiration, guidance and stimulation.

*The Science Teacher:* Here is the greatest personal influence in the life of the potential scientist in terms of help and encouragement to become a scientist. He was an admirable person in: personality, preparation for his calling, in possession of a philosophy of all pervading freedom and he set an example of very high standards of personal performance. He appeared to: love his job and his students, and the feeling was mutual. He symbolized the very best in permissive progressive science education.

*The Potential Scientist:* The combined influences of all these factors produced a young person that we may call "the beloved egg-head." He had the capacity to self direct his energies at a high speed along the narrow pathways of limited scientific interests toward remote goals. His diversion was usually one of the appreciation of one of the fine arts or, for public entertainment held no appeal for him.

*The Challenge:* Is our need for potential scientists great enough for us to be willing and able to provide this kind of an environment for their identification, growth, and development? It appears that the price will be high for the important factors are capacity, interest, scientific influences and freedom. These are delicate words that can easily be nullified or destroyed by some other words or phrases like these: "all are created equal," "do what is good for you," "father knows best," "be well rounded," "be somebody in this world," "in my day we did it this way," "quiet," "obey the law," "don't be an icky," "conform," "majority is always right," "be nice," "make people like you," "everybody is doing it,"

"everybody treated alike," "mastery of fundamentals," "model age norms," "take it easy," "academic preparation," "classical values," "good old Latin," "hard work makes strong men," "the good old days," knowledge for its own sake," "don't bother me, you are too young yet," "earn some pocket money," "pay your own way—always," and "I will do that tomorrow."

*The Acceptance:* This is the warp and the woof in the tapestry of time that must envelop potential scientists. It is the price that we must pay to produce the rare student that we seem to want, at least today! Do we truly want to use these delicate words: capacity, interest, scientific influences, freedom? Do we really want him this much? Do we like these other words and phrases better? One wonders!

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7. Terman, L. M., *Scientists and Non-scientists in a Group of 800 Gifted Men*, Psychological Monographs, 1954, No. 837, Vol. 68, No. 7.
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Advances in understanding the workings of life processes and such serious diseases as sleeping sickness are expected to come from research on the eating habits of the protozoan, *Cryptidium fasciculata*. It was reported that the newly-discovered nutritional agent is the growth-promoting substance, a yellow pigment named biotin, related to the coloring substances in the wings of butterflies and found recently in the eye pigments of fruit flies.

# The Number of Seeds Produced By Certain Plants

G. NEVILLE JONES

Department of Botany  
University of Illinois

Although there have been several studies of the number of spores, seeds, or fruits produced by various plants, for the great majority of our common wild plants little or nothing is actually known about this subject. The following notes may therefore be of interest. In May, 1956, I transplanted from woods in Robert Allerton Park, near Monticello, Piatt Co., Illinois, one plant of giant hyssop, *Agastache nepetoides* (L.) Kuntze (Labiatae) to my garden in Urbana. This plant soon grew about six feet tall and developed twenty or more lateral branches. It produced flowers continuously for about four months, from July until the end of October and the beginning of November. Toward the end of the flowering period I counted 48 inflorescences on the plant. The average number of whorls of flowers in each inflorescence was 32, with an average number of 42 flowers in each whorl. It is well known to botanists that the pistil of flowers of the mint family is bicarpellate. Early in its development a constriction appears in the ovary dividing each carpel into two locules. Each locule has one basal erect anatropous ovule, and the fruit is a group of four achenes or nutlets each containing one seed, if all mature. Hence it will be seen that if the plant under observation produced an estimated number of 64,512 flowers, the possible total number of seeds would be approximately 258,048 or something over a quarter of a million. It should be noted, however, that the number of seeds produced under cultivation is probably higher than that produced by most wild plants, as cultivated plants may attain a larger size, and their flowering season may be longer. Calculations made from herbarium specimens are likely to indicate a somewhat smaller number of seeds, as such specimens are usually taken from smaller plants in prime flowering condition, with shorter and less ma-

ture inflorescences. In any case, only a small part of the full grown plant can be made into a standard herbarium specimen. By way of comparison, the average number of corn plants (*Zea mays*) per acre in Illinois is said to be about 12,000. If all the seeds from one giant hyssop germinated and were planted in rows like those of maize, the number of plants would be sufficient to fill a 21-acre field.

Many other plants produce a much larger number of seeds. For example, my attention has been drawn by Dr. H. J. Fuller, the editor of "Plant Science Bulletin," to some unpublished observations by Dr. C. F. Hottes, Professor of Botany, Emeritus, at the University of Illinois. Near Urbana in 1895 he collected from a single plant of the redroot pigweed, *Amaranthus retroflexus* (L.), an estimated number of 2,359,000 seeds, and another species of the same genus, *A. albus* (L.), yielded 1,606,000. Specimens to support these statements and to verify the taxonomic identity of the plants are deposited in the Herbarium of the University of Illinois as jars of seeds collected by Dr. Hottes, and a herbarium specimen (G. N. Jones 20925) of the giant hyssop.

While this sort of observational study has a certain amount of purely scientific interest, it can also serve as a device for training high school students in a simple scientific procedure, as well as providing an exercise in practical plant ecology.

## Letter from Australia

INTERNATIONAL RELATIONS COMMITTEE  
Standing Committee of the Australian Science  
Teachers' Association  
Hon. Secretary: Murray L. Yaxley  
Hobart High School  
Letitia Street, North Hobart, Tasmania

22nd October, 1956

Mr. Richard Armacost,  
Purdue University,  
West Lafayette,  
Indiana . . . U. S. A.

Dear Mr. Armacost,

I have noted in the "Science Teaching News Letter" (UNESCO) that you are the editor of "The American Biology Teacher" (National Association of Biology Teachers).

(Continued on next page)

I write to acquaint you with the existence of, and the work of, the International Relations Committee of the Australian Science Teachers' Association. I am enclosing a copy of the statement of its functions and duties.

I would be glad to correspond with you or any of the members of N.A.B.T. to whom our work might be of interest. Would you please bring the existence of this committee to the notice of your members?

Yours sincerely,  
Murray L. Yaxley

*Duties of the Australian Science Teachers'  
International Relations Committee*

In general terms, the work of the Committee, and its Secretary in particular, shall be to collect, collate and disseminate information subject to A.S.T.A. direction, and to act as a forwarding address for A.S.T.A. in order that continuity of contacts with agencies outside Australia may be secured. It is to be understood that matters of policy of any nature shall not come within the jurisdiction of the Committee or its Secretary.

In particular, the duties shall be:—

1. (a) To collect documents and publications of overseas agencies and science teachers' associations and to bring them to the notice of A.S.T.A. and affiliated associations.

(b) To send materials produced by Australian associations to overseas agencies and associations when instructed by A.S.T.A. or when requested by these overseas bodies, provided that, in the latter case, A.S.T.A. is informed.

2. (a) To bring to the notice of overseas agencies and associations news of various activities and personalities of A.S.T.A. and affiliated associations, with permission to republish as desired.

(b) To prepare activity news and personal items concerning the overseas agencies and associations, and forward them to A.S.T.A. and affiliated associations for publication if they desire.

3. To collect special Australian science material for use in occasional overseas publications when instructed by A.S.T.A. or when requested by overseas bodies, provided that, in the latter case, prior permission has been obtained from A.S.T.A.

4. To keep A.S.T.A. and affiliated associa-

tions informed of noteworthy items gathered incidentally from outside Australia, such as opportunities for exchange of science teachers between countries, opportunities for exchange of ideas, etc.

5. To act as required as a forwarding address for A.S.T.A. for communications from overseas agencies and associations.

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## Summer Institute In Biology At Purdue University

A grant of \$60,000 has been awarded by the National Science Foundation to the department of Biological Sciences of Purdue University for the purpose of supporting an eight-weeks' summer institute for Mid-West high school teachers of biology. This announcement was made by Dr. John S. Karling, head of the department, who has just returned from a meeting of the Foundation in Washington, D.C.

This grant is one of several given to colleges and universities in the United States for the purpose of increasing factual knowledge of the sciences among high school science teachers. The National Science Foundation and several other national science organizations have become conscious of the lack of subject matter knowledge among high school science teachers and are working to recruit and train future science teachers and research scientists by placing more emphasis on the knowledge of science itself rather than solely on the methods courses of teaching. In accordance with this program, the National Science Foundation is allocating nearly ten million dollars of its budget to various colleges and universities to support high school teachers' institutes.

From this allotment, funds for salaries, traveling expenses, and subsistence are provided for high school teachers and their families so that they will be adequately paid while learning and need not seek summer employment in industry or elsewhere to supplement their income.

The University summer institute of biology will be under the direction of Dr. Richard R.

Armacost, professor of educational biology, and will consist of eight weeks of intensive lecture, demonstration and laboratory instruction in general biology, bacteriology, biophysics, botany and zoology for fifty carefully selected teachers. Members of the biology staff will offer instruction in their respective fields of teaching and research, and this staff will be supplemented by outstanding biologists from other universities.

The Institute will be co-sponsored by the National Association of Biology Teachers. Most, but not all, of the participants will be selected from the Mid-West States. A brochure describing the program in detail will be available by the end of January. Requests for this information should be addressed to: Dr. Richard R. Armacost, Department of Biological Sciences, Purdue University, West Lafayette, Indiana.

## Books for Biologists

**THE CLASSIFICATION OF LOWER ORGANISMS**, Herbert F. Copland, 302 pp. \$7.50, Pacific Books, Palo Alto, California, 1956.

It is usually accepted as a law of nature that all living things make up two kingdoms, plants and animals. As to nearly all creatures visible to the naked eye, this view is sound; but the microscope has revealed various groups which are not definitely either plants or animals, some of them being quite definitely neither.

In this book definite limits are given to the kingdoms of plants and animals. To escape the extreme heterogeneity of the "third kingdom" as proposed by some authors, the organisms excluded from plants and animals are organized as two kingdoms instead of one. Scientific names are applied in strict conformity to the recognized principles of nomenclature.

**YOU AND YOUR SENSES**, Leo Schneider, 137 pp., \$2.75 Harcourt, Brace and Company, New York, New York, 1956.

Seeing, hearing, tasting, smelling, and touching—these are the five means you have of finding out what is going on around you. You have used most of these from the moment you were born, but have you ever really understood how your senses work?

In clear readable prose Leo Schneider explains how the five senses report on the world around us. Throughout the basic principles and interest-

ing sidelights are presented in a logical fashion, with numerous diagrams and drawings. Young people in search of information will find this book absorbing and satisfying reading.

**SCIENCE AND MODERN LIFE**, Sir. E. John Russell, 101 pp., \$2.75, Philosophical Library, New York, New York, 1955.

The book deals with some of the problems arising out of the rapid advance of science and technology. Man's moral stature has not kept pace with his increase of knowledge and power. Science alone can solve these problems: fortunately there are signs of happier relationships between science and religion, and therein lies the best hope for the future.

**CLASSICS OF BIOLOGY**, August Pi Suner, Authorized English translation by Charles M. Stern, 337 pp., \$7.50, Philosophical Library, New York, New York, 1955.

This survey illuminates the high points of progress in the study of biology by providing fascinating glimpses of the philosophical theories which have been propounded in different ages up to our own time.

Famous controversies are discussed and extensive textual extracts from outstanding works of more than sixty writers.

Teachers of biology, philosophy, and history of science, as well as the general reader and the serious student, will find in this stimulating book much to discuss.

**PRINCIPLES OF EMBRYOLOGY**, C. H. Waddington, 509 pp., \$7.50, The Macmillan Company, New York, New York, 1956.

The book provides an account of development processes, seen as part of a modern casual biology. The main emphasis, however, is on experimental analysis. In the first part of the book, the basic experimental facts are discussed. In the second part, there are more general discussions of the fundamental development mechanism. Perhaps the most novel feature of the book is the detailed way in which the data of experimental embryology and modern genetics are brought together.

**BIOLOGY OF THE LABORATORY MOUSE**, compiled by the staff of the Roscoe B. Jackson Memorial Laboratory, Edited by George D. Snell, 497 pp., \$6.00, Dover Publications, Inc., New York, New York, 1956.

This book covers almost all important aspects of the laboratory mouse. It gathers together fundamental information from many fields of study, and makes it easier for the research worker using mice as experimental material to cover several overlapping areas of science. It is not concerned

(Continued on page 26)

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Nos. 1-8, 1956

Compiled by John D. Woolever  
Sarasota High School, Sarasota, Florida

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This is a book for teen-agers planned to link the facts of biology to health. The work of the World Health Organization of the United Nations is also discussed. Chapters are devoted to: energy and the web of life; how worms affect us; microbes; viruses; how man protects himself; how science helps man protect himself; what influences health; and how health can be measured.

**GEOLOGY AND OURSELVES**, T. H. Edmunds, 256 pp., \$10.00, New York Philosophical Library, New York, New York.

A special geological investigation is today an essential prelude to all mining for coal or metallic ores, to boring of water, oil or natural gas, to driving a tunnel or erecting a heavy building. After a preliminary outline of the broad principles of geology, the author explains how geologists can deduce the subterranean contents and structure of the land from observations made on the ground surface.

The comparatively new studies of geophysics, geochemistry, and soil mechanics are introduced. The book is clearly written and is illustrated with numerous diagrams and photographs.

**ALCOHOLISM ITS PSYCHOLOGY AND CURE**, Frederick B. Rea, 143 pp., \$3.50, Philosophical Library, New York, New York, 1956.

The need for a new approach to temperance reform has long been recognized. The old one, however valuable it may have been in its time, has the air of belonging to a past age, and its war-cries have little power to stir the present generation, though its subject is still one of the

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**THE FACTS OF LIFE**, C. D. Darlington, 467 pp., \$7.00, George Allen and Unwin Ltd. Ruskin House Museum Street, London, England, 1953.

This book begins as a history of man's attempts to discover the facts about himself. It goes on to deal in detail with the immense possibilites in the principles of heredity to the great problems of society—education, of medicine, of crime and punishment, of marriage and divorce, of the relations of races and classes, and, taking a long

view of evolution. The conclusion is a philosophy of determinism which is very old so far as the name goes. But the evidence on which Dr. Darlington bases his argument has been brought together only in the last thirty years. The results is therefore, in effect, a new philosophy of life.

**BIRDS AND BUTTERFLY MYSTERIES**, Bernard Acworth, 303 pp., \$7.50, Philosophical Library, New York, New York, 1956.

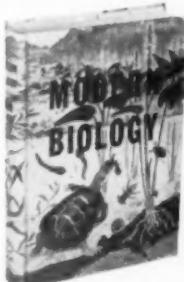
Captain Acworth here offers in his new book his solutions of some of the mysteries surrounding the habits and life histories of birds and butterflies.

**INTRODUCTION TO PARASITOLOGY**, Chandler, A. C. John Wiley & Sons, Inc., New York, 799 pp. 1955, \$8.50.

The ninth edition of a highly successful textbook and reference. Primarily biological in its approach to parasites, it stresses their importance, life cycles, epidemiology, pathogenicity, immunology and modes of prevention or control.

**A SHORT HISTORY OF MEDICINE**, Ackerknecht, E. H. Ronald Press Co., New York, 258 pp. 1955, \$4.50.

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